APPENDIX E

HAZARD ANALYSIS OF ANHYDROUS AMMONIA TRUCK ACCIDENT

Title: Transport Company of Texas, Tractor Semitrailer (Tank) Collision with Bridge Column and Sudden Dispersal of Anhydrous Ammonia Cargo, Houston, Texas, May 11, 1976.
NTSB Report Number: HAR-77/01, adopted on April 14, 1977. Accessed at http://www.ntsb.gov/publictn/1977/HAR7701.htm

NTIS Report Number: PB-268251

SYNOPSIS

About 11:08 a.m., on May 11, 1976, a Transport Company of Texas tractor-semitrailer (tank) transporting 7,509 gallons (about 19 tons at about 5 lb/gal) of anhydrous ammonia struck and penetrated a bridge rail on a ramp connecting I-610 with the Southwest Freeway (U.S. 59) in Houston, Texas. The tractor and trailer left the ramp, struck a support column of an overpass, and fell onto the Southwest Freeway, approximately 15 ft below. The anhydrous ammonia was released nearly instantaneously from the damaged tank semitrailer. Six persons died as a result of the accident, 78 persons were hospitalized, and approximately 100 other persons were treated for injuries.

AIR DISPERSION MODELING

The ALOHA air dispersion model (NOAA 2006) was used to estimate potential impacts of ammonia downwind of the actual truck accident, as applied to the Orlando area rather than Houston. As a conservative (upper-bound) assumption, the average population density of Orange County was applied along the entire length of a shipment from the Stanton Energy Center to Jacksonville (Section 4.1.9.2). Table E.1 provides the assumptions and various inputs. Table E.2 presents the results from the ALOHA model, and Figure E.1 shows a graphical representation of the toxic threat zone from which the potential impacts were estimated.

The estimated toxic impacts for ammonia predicted by ALOHA are based on the American Industrial Hygiene Association's Emergency Response Planning Guide (ERPG) values (Table E.1). For the route from the Stanton Energy Center to Jacksonville, approximately 655 people are predicted by ALOHA to be in the ERPG-3 zone (with ammonia concentrations of at least 750 ppm), which is the area in which a 1-hour exposure would be expected to produce life-threatening health effects. About 1,091 people are predicted to be in the ERPG-2 zone (with ammonia concentrations of at least 150 ppm but less than 750 ppm), which is the area in which a 1-hour exposure would be expected to produce irreversible or other serious health effects or symptoms that might limit their ability to take protective action. Approximately 4,146 people are predicted to be in the ERPG-1 zone (with ammonia concentrations of at least 25 ppm but less than 150 ppm), which is the area in which a 1-hour exposure would be expected to produce mild, transient health effects or a perception of a clearly defined, objectionable odor. Altogether, about 13,000 people would require sheltering in place or evacuation to preclude exposures at the level of ERPG-1 or higher (see confidence lines in Figure E.1).

The ALOHA model was also used to calculate a flammable threat zone and overpressure (blast force) threat zone for the same 19-ton instantaneous release of ammonia following a truck accident but, because the consequences were much less than the consequences for the toxic threat zone, those results are not presented in this document.

Table E.1. ALOHA model input data for truck accident in Houston, Texas, May 11, 1976, as applied to the Orlando area

SITE DATA

Location: ORLANDO, FLORIDA

Building Air Exchanges Per Hour: 1 (user specified)

Time: April 28, 2006 0440 hours EDT (using computer's clock)

CHEMICAL DATA

Chemical Name: AMMONIA

Molecular Weight: 17.03 g/mol

ERPG-1: 25 ppm ERPG-2: 150 ppm ERPG-3: 750 ppm

IDLH: 300 ppm LEL: 160,000 ppm UEL: 250,000 ppm

Ambient Boiling Point: -28.3° F

Vapor Pressure at Ambient Temperature: greater than 1 atm

Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA

Wind: 7 mph from 235° (true heading) at 3 meters

Ground Roughness: urban or forest

Air Temperature: 85° F

No Inversion Height

Cloud Cover: 7 tenths

Stability Class: D

Relative Humidity: 75%

SOURCE STRENGTH AND CHARACTERISTICS

Leak from hole in horizontal cylindrical tank

Flammable chemical escaping from tank (not burning)

Tank Diameter: 7 ft - tank Length: 39.9 ft

Tank Capacity: 11,500 gal

Tank contains liquid - internal Temperature: 85° F

Chemical Mass in Tank: 23.5 tons - tank is 82% full

per DOT restrictions for non-insulated cargo tank

Rectangular opening: 30 x 4 in.

Opening is 3.25 ft from tank bottom

Release Duration: 1 minute

Max Average Sustained Release Rate: 632 lb/s (averaged over one minute)

Total Amount Released: about 7,583 gal or 37,913 lb (about 19 tons)

The chemical escaped as a mixture of gas and aerosol (two phase flow).

Table E.2. Toxic threat zone data, as presented in Figure E.1

Threat modeled: Toxic area of vapor cloud
Model run: Heavy gas
Red: Downwind distance of 1.4 miles --- (750 ppm = ERPG-3)
Orange: Downwind distance of 2.7 miles --- (150 ppm = ERPG-2)
Yellow: Downwind distance of 5.7 miles --- (25 ppm = ERPG-1)
Black: 95% confidence lines for ERPG-1

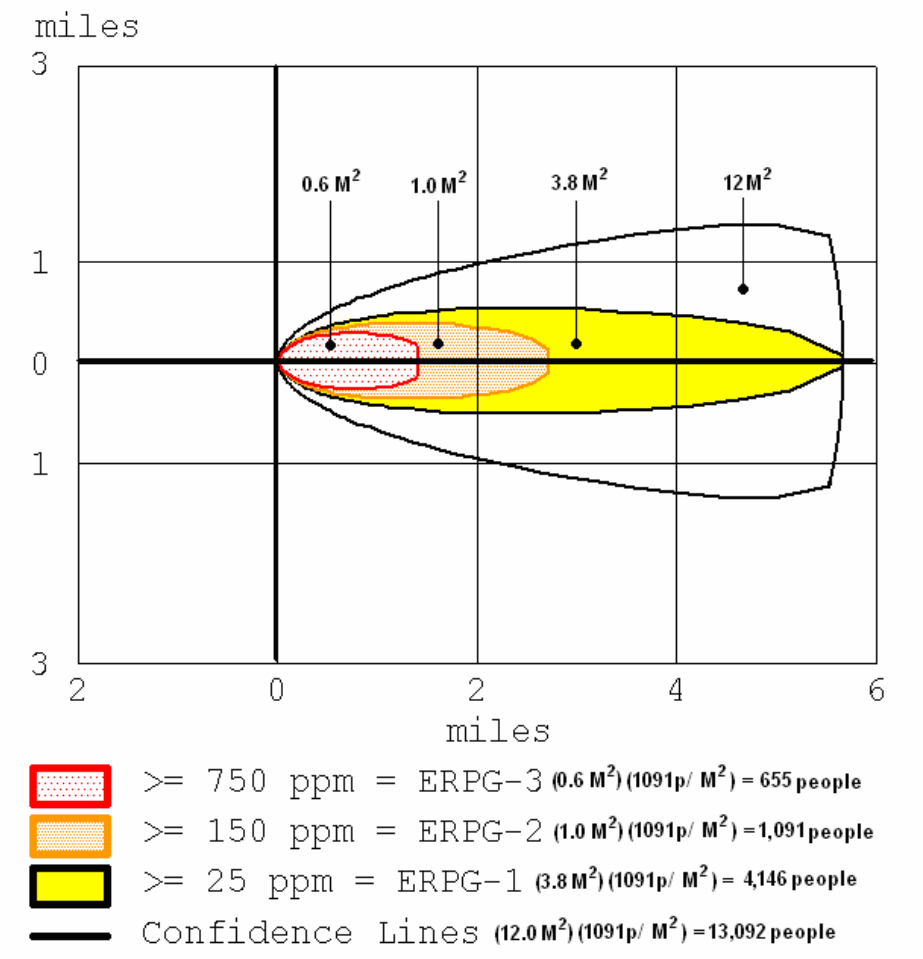

Figure E.1. Downwind area associated with toxic threat zone predicted by the ALOHA model.